IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Date: October 26, 2004

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JOHN M. ROTH

Serial No.: 10/064,006 Group Art Unit:3747

Filed : June 4, 2002 Examiner: Bibhu Mohanty

For : OVERALL SCHEDULING OF A LEAN BURN ENGINE SYSTEM

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Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

S i r :

INFORMATION DISCLOSURE STATEMENT
UNDER 37 C.F.R. §§ 1.56, 1.97, and 1.98

Applicants are submitting this Information Disclosure Statement pursuant to 37 C.F.R. §§ 1.56, 1.97, and 1.98 to disclose to the U.S. Patent and Trademark Office the patents, publications, applications, and/or other references listed on the enclosed, completed PTO-1449 forms. The filing of this Information Disclosure Statement should not be construed as a representation that a search has been made or as an admission that the listed references are prior art for this application. Applicants respectfully request that the listed references be expressly considered during prosecution of the application, and that the references be made of record therein and appear among the "references cited" on any patents issuing therefrom.

CONTENT OF DISCLOSURE

This Information Disclosure Statement includes (1) 2 pages of PTO-1449 forms, and (2) a legible copy of each reference listed on the forms.

FOREIGN-LANGUAGE REFERENCES

A concise explanation of the relevance of each listed reference not in the English language follows:

German Patent No. 196 07 151: This patent purports to disclose a method by which Nitrogen oxides storage catalyst (4) is regenerated in accordance with the operational state of the catalyst (4). During regeneration, the mixture supplied to the internal combustion engine corresponds to a stoichiometry ratio less than one (rich), ahead of the catalyst. The operational state corresponds to at least a limiting quantity of NOx compounds issuing from the catalyst. The quantity of NOx is evaluated from a characteristic diagram, which is a function of the loading and rotary speed of the engine.

Japanese Patent No. 2-207159: This patent purports to disclose a method to judge deterioration with high precision by judging that a ternary catalyst is deteriorated when the time until the output of an air-fuel ratio sensor on the downstream side of the ternary catalyst is reversed from rich to lean after the air-fuel ratio of an engine is reversed from rich to lean is the preset time or below.

The air-fuel ratio of an engine is adjusted by a means D in response to outputs of air-fuel ratio sensors B and C on the upstream side and the downstream side of a ternary catalyst A installed on the exhaust passage of an internal combustion engine. When the engine is in the preset operation state, the air-fuel ratio of the engine is forcefully made rich by a means E, then it is reversed to lean. A means F judges that the output

of the air-fuel sensor C on the downstream side is reversed from rich to lean. The time until the output of the air-fuel ratio sensor C on the downstream side is reversed from rich to lean after the air-fuel ratio is forcefully reversed is measured by a means G. When the measured time is the preset time or below, a means H judges that the ternary catalyst A is deteriorated.

Japanese Patent No. 2-030915: This patent purports to disclose a method to accurately judge the degradation of catalytic converter rhodium when an instrumentation time is less than a predetermined time by measuring a time from when an internal combustion engine is shifted to rich operation condition to when the output of an air/fuel ratio sensor at the down stream side of the catalytic converter is reversed to rich condition.

Respective air/fuel ratio sensors c, d are provided at the upper and down stream sides of catalytic converter rhodium b provided at the exhaust passage a of an internal combustion engine and the air/fuel ratio of the internal combustion engine is adjusted by a means e according to those respective detected results. At this time, reverse between the lean and rich condition of the output of the down stream side air/fuel ratio sensor d is judged by a means (f). The operation condition of the internal combustion engine is judged by a means g that theoretical air/fuel ratio operation condition is shifted to rich operation condition. Further, a time from the shift to when the output of the down stream side air/fuel ratio sensor d is reversed from lean condition to rich condition is measured by a means h. When the measured time is less than a predetermined time, the degradation of the catalytic inverter rhodium b is judged by a means t.

Japanese Patent No. 2-033408: This patent purports to disclose a method to get rid of wrong discrimination of

catalytic degradation by measuring a discharging time of O2 from tree way catalyst at a time of forced conversion to the state of a rich or theoretical air fuel ratio so as to indirectly measure the maximum storage quantity of O2 of the three way catalyst.

An air fuel ratio adjusting means A adjusts an air fuel ratio of an engine according to outputs V1, V2 of air fuel ratio sensors on the upstream and downstream sides of three way catalyst CCRO. A time measuring means B measures a time TA since it is judged that an operating state has transited from a lean operating state to a rich or theoretical air fuel ratio operating stage by a rich/lean operation state transition discriminating means C until it is discriminated that the output V2 of the air fuel ratio sensor on the downstream side has reversed from the lean to the rich by a repeat discriminating means D. And a catalytic degradation discriminating means E discriminates that the tree way catalyst has degraded when the measured discharging time TA of O2 from the three way catalyst is shorter than a fixed time. Thus it is possible to discriminate the degradation of the three way catalyst precisely.

Japanese Patent No. 3-135417: This patent purports to disclose a method to decompose NOx with reduction catalyst without the need of ammonia by adsorbing NOx in the exhaust gas of engine, desorbing it with the combustion gas of low O2 concn., and passing it through the reduction catalyst to decompose NOx into N2 and O2.

There are provided the NOx adsorption unit 4 in which zeolite, etc., is used as an adsorbent, a high temp. gas generation unit 7, and a reduction unit 5 provided with the reduction catalyst. NOx in combustion gas is adsorbed in the NOx adsorption unit 4, and then desorbed by the high temp. gas of low O2 concn. sent from the high temp. gas generation unit 7,

and the desorbed NOx is decomposed by the reduction unit 5 into N2 and O2. As a result, the NOx in the exhaust gas of engine, especially of diesel engine, is removed. The device of this system is allowed to be miniaturized because reduction gas, such as ammonia, is not used.

Japanese Patent No. 5-106493: This patent purports to disclose a method to accurately determine whether or not a catalyst is deteriorated by considering the characteristics of O2 storage ability of the catalyst.

A first time measuring means M1 measures the length of time TL between the point of time when an air fuel ratio control means M1 changes the air fuel ratio to the Lean side and the point of time when the output of a downstream side O2 sensor RS changes from Rich to Lean side. A second time measuring means M2 measures the length of time TR between the point of time when the air fuel ratio is changed to the Rich side and the point of time when the output of the downstream side O2, sensor RS changes from Lean to Rich side. A catalyst deterioration means M4 determines whether or not a catalyst is deteriorated when the average of the lengths of time TL and TR is shorter than a specified length of time. The lengths of time TL and TR are successively measured in that order to allow both length of time for the catalyst to absorb O2 and NOx and length of time to absorb CO and HC to be properly considered, so that the O2 storage ability of the catalyst can be accurately detected to allow accurately determining whether or not the catalyst is deteriorated.

Japanese Patent No. 5-106494: This patent purports to disclose a method to provide a catalyst deterioration determination device which is rarely affected by the dispersion and deterioration of unitary performance of an O2 sensor.

CONSTITUTION: Ordinarily, a first air fuel ratio control means

M1 feed-back- controls an air fuel ratio based on the output of both an upstream side O2 sensor FS and a downstream side O2 sensor RS for a catalyst C. When an operation state determination means M3 identifies a specified engine operation state, an adjustment means switch means M4 switches from a first air fuel ratio adjustment means M1 to a second air fuel ratio adjustment means M2 and feed-back-controls the air fuel ratio based on only the output of the downstream side O2 sensor RS. At this time, a time measuring means M6 measures the length of time between the point of time when the amount of skip which causes the increase of the air fuel ratio occurs and the point of time when a reverse determination means M5 detects the reversal of the output of the downstream side O2 sensor RS and when the length of time becomes shorter than a specified value, a catalyst deterioration determination means M7 determines that the catalyst C is deteriorated.

Japanese Patent No. 5-026080: This patent purports to disclose a method to prevent the lowering of NOx purifying ability when air-fuel ratio control is changed from a lean control mode to a theory air fuel ratio control mode, by controlling the air-fuel ratio on a a rich side until the output of a rear oxygen sensor is reversed to the theory air fuel ratio side from the lean side.

A catalyst converter 3 housing a lean NOx catalyst 4 and a ternary catalyst 5 is furnished at the middle of an exhaust gas pipe passage 2, and front and rear oxygen sensors 6, 7 are provided at the upstream and downstream parts of this converter 3. And an air fuel ratio is controlled by means of an ECU 8 on the basis of the output of the front sensor 6, and also the control of the air-fuel ratio is corrected on the basis of the output of the rear sensor 7, and at the same time the air fuel ratio is controlled by changing it to a lean control mode A or a

theory air-fuel ratio control mode B according to an engine operation situation. On the occasion of this air-fuel ratio control, when the air-fuel ratio is changed to the B from the mode A, arrangement is made so that the air-fuel ratio may be controlled on the rich side until the output of the rear sensor 7, from the viewpoint of the air-fuel ratio, is changed to the theory air-fuel ratio side from the lean side.

Japanese Patent No. 62-117620: This patent purports to disclose a method to efficiently perform denitration by bringing NOx into contact with a catalyst under the presence of O2 to oxidize and absorb it and stopping the pass of exhaust gas at the point of time when the absorption efficiency of the catalyst is reduced and using a gaseous reducing agent to reduce NO2 of the catalyst.

Exhaust gas discharged from a manifold is introduced into an oxidizing catalyst to convert CO into CO2 and introduced into either catalyst of the parallel catalysts A, B and NOx is oxidized and absorbed to the catalyst under the presence of O2. Various metals such as Mn and Fe, oxide thereof and composite oxide are used as the catalyst. When exhaust gas is introduced into the catalyst layer of one hand for a specified time and absorption efficiency is reduced, the flow of exhaust gas is changed over to the catalyst layer of the other hand and H2 is introduced into the catalyst layer wherein exhaust gas is not flowed from an H2 generator to remove NOx and the catalyst is regenerated.

Japanese Patent No. 6-264787: This patent purports to disclose a method to maintain an exhaust nature favourable even at the time of detection of a lean NOx catalyst and improve the fuel consumption performance.

In an engine purifying NOx generated at the time of burning fuel at a lean air fuel ratio by a lean NOx catalyst,

deterioration of the lean NOx catalyst is judged (S41). Thereafter, an objective lean air fuel ratio set at an air-fuel ratio at which fuel consumption becomes most favourable in an initial state is gradually made lean in accordance with progress of deterioration of the lean NOx catalyst.

Japanese Patent No. 62-97630: This patent purports to disclose a method to efficiently remove NOx, by contacting NOx with a catalyst in the presence of O2 to oxidize and absorb the same by the catalyst and stopping the flowing of exhaust gas at the point of time when absorbing efficiency was lowered to contact the catalyst with a reducing agent to recover the oxidizing/absorbing capacity thereof.

NOx-containing exhaust gas is introduced into a catalyst A through a cock C1 to react NOx in exhaust gas in the catalyst in the coexistence of O2 to be absorbed by the catalyst. The exhaust gas is discarded into the atmosphere through a cock C2 while NOx is exhausted. At the point of time when the removing capacity of the catalyst was lowered, the cocks C1, C2 are changed over and exhaust gas is introduced into a catalyst B. During this time, reducing gas such as H2 is introduced into the catalyst A through a cock C3 to reduce NOx absorbed and oxidized in the catalyst. The treated gas issued from the catalyst A is discarded into the atmosphere but, when there is the unreacted reducing agent, the treated gas is introduced into the catalyst B to oxidize the reducing agent.

Japanese Patent No. 6-58139: This patent purports to disclose a method to reduce the coat and improve the purge efficiency as the thermal damage of the adsorbent of an adsorbing device is prevented from occurring.

A bypass passage B is arranged in an exhaust gas passage A, an adsorbing device C is located in the bypass passage B, and a catalyst device D is arranged in the exhaust gas passage A

situated downstream from the bypass passage B. When the adsorbent temperature of the adsorbing device C is below first set value, a total amount of exhaust gas in introduced to the bypass passage B by means of a control valve E alone to adsorb HC. When it exceeds a second set value, purge control of HC is effected through control of an amount of exhaust gas introduced to the bypass passage B so that an adsorbent temperature is held at a second set temperature lower than an adsorbent limit temperature. Further, from a change amount of an air-fuel ratio in exhaust gas, detected by an oxygen sensor H during purge control, to the rich side, it is decided that purge is completed.

Japanese Patent No. JP 7-97941: This patent purports to disclose a method to effectively purify NOx during lean-burning driving by temporarily switching the driving state to that having the stoichiometric air-fuel ratio or the excessive rich side air-fuel ratio when NOx purifying efficiency of an NOx purifying member having specific property is deteriorated during lean-burning driving of an internal combustion engine.

In an internal combustion engine 1, an intake passage 3 and an exhaust passage 4 are respectively communicated to a combustion chamber 2 through an intake valve 5 and an exhaust valve 6. And an NOx purifying member 100 and a catalytic converter rhodium 10 are respectively arranged in the exhaust passage 4 from the upstream side in this order. That is, since the NOx purifying efficiency of the NOx purifying member 100 is decreased with time when the engine is driven by lean-burning, the NOx purifying member is so set as to have property wherein the NOx purifying efficiency is restored when the driving state is switched to that having the stoichiometric air-fuel ratio or the excessive rich side air-fuel member 100 is deteriorated during lean-burning driving of the internal combustion engine 1,

the driving state is temporarily switched to that having the stoichiometric air-fuel ratio or the excessive rich side air-fuel ratio.

Japanese Patent No. 7-166851: This patent purports to disclose a method to efficiently purify exhaust by operating an NOx absorbent properly regenerated in accordance with change in its absorbing ability, preventing an exhaust nature from worsening due to decrease in the absorbing ability of the NOx absorbent, and also effectively applying the absorbing ability of the NOx absorbent.

A NOx sensor 20 is arranged in the downstream of an NOx absorbent 18 ion an exhaust passage 17 of an internal combustion engine, and based on detected concentration of an NOx component, when decided worsening NOx absorbing ability of the NOx absorbent 18, the NOx absorbent is regenerated.

TIMING OF DISCLOSURE

This Information Disclosure Statement is being filed after the mailing date of a final action under 37 C.F.R. § 1.113, a notice of allowance under 37 C.F.R. § 1.311, or an action that otherwise closes prosecution in the application, but on or before payment of the issue fee. Therefore, in accordance with 37 C.F.R. § 1.97(d), submitted herewith are (1) the statement specified in 37 C.F.R. § 1.97(e), and (2) the fee set forth in 37 C.F.R. § 1.17(p).

FEE INFORMATION

The Commissioner is hereby authorized to charge $180.00 for payment of the fee set forth in 38 C.F.R. § 1.17(p) and any additional fees that may be required, or to credit any overpayment, to Account No. 06-1510. A duplicate copy of this sheet is enclosed.

Please contact the undersigned with any questions or comments regarding this Information Disclosure Statement.

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I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Mail Stop ISSUE FEE, Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450, on October 26, 2004.

Lauren Barberena

Respectfully submitted,

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 3

Complete if Known	
Application Number	10/064,006
Filing Date	June 4, 2002
First Named Inventor	Gopichandra Surnilla
Art Unit	3747
Examiner Name	Bibhu Mohanty
Attorney Docket Number	81046568

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] if known	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		US-			
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FOREIGN PATENT DOCUMENTS

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		DE 196 07 151	07-10-97	Siemens AG		
		EP 0 351 197	01-17-90	Johnson Matthey		
		EP 0 444 783	09-04-91	Lucas Industries		
		JP 2-207159	08-16-90	Toyota		
		JP 2-30915	02-01-90	Toyota		
		JP 2-33408	02-02-90	Toyota		
		JP 3-135417	06-10-91	Matsushita Electric		
		JP 5-106493	04-27-93	Honda		
		JP 5-106494	04-27-93	Honda		
		JP 5-26080	02-02-93	Mitsubishi Motors		
		JP 62-117620	05-29-87	Nippon Shokubai		
		JP 6-264787	09-20-94	Nissan Motor		
		JP 62-97630	05-07-87	Nippon Shokubai		
		JP 64-53042	03-01-89	Mitsubishi Motors		
		JP 6-58139	03-01-94	Nissan Motor		
		JP 7-97941	04-11-95	Kazuhiro et al		

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		EP 0 351 197	01-17-90	Johnson Matthey		
		EP 0 503 882	09-16-92	S. Takeshima		
		EP 0 580 389	01-26-94	Toyota		
		WP 98/27322	06-25-98	Ford Motor Co.		
		JP 7-166851	06-27-95	Toyota		

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First Named Inventor	Gopichandra Surnilla
Art Unit	3747
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NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
		JOE THEIS et al, "An Air/Fuel Algorithm to Improve The NOx Conversion of Copper-Based Catalysts", SAE Technical Paper No. 922251, October 19-22, 1992, pp. 77-89.	
		ALAN F. DIWELL, "Engineered Control Strategies For Improved Catalytic Control of NOx in Lean Burn Applications", SAE Technical Paper No. 881595, 1998 pp. 1-11.	
		ALLEN H. MEITZLER, "Application of Exhaust-Gas-Oxygen Sensors to the Study of Storage Effects in Automotive Three-Way Catalysts", SAE 800019, February 25-29, 1980.	
		W.H. HOLL, "Air Fuel Control to Reduce Emissions, I. Engine-Emissions Relationships", SAE 800051, February 25-29, 1980.	
		WEI-MING WANG, "Air-Fuel Control to Reduce Emissions, II. Engine-Catalyst Characterization Under Cyclic Conditions", SAE 800052, February 25-29, 1980.	
		Y. KANEKO et al, "Effect of Air-Fuel Ratio Modulation on Conversion Efficiency of Three-Way Catalysts", INTER-INDUSTRY EMISSION CONTROL PROGRAM 2 (IIEC-2) PROGRESS REPORT NO. 4, SAE Technical Paper No. 780607, June 5-9, 1978, pp. 119-127.	
		TOSHIAKI YAMAMOTO et al, "Dynamic Behavior Analysis of Three Way Catalytic Reaction", JSAE 882072-882166	

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